

Name: Solutions

Solve each exponential equation:

1. $e^{3x} = e^{12}$ $3x = 12$ $x = 4$

2. $16^x = 4^3$ $4^{2x} = 4^3$ $2x = 3$ $x = \frac{3}{2}$

3. $3^x = \frac{1}{27}$ $3^x = \frac{1}{3^3}$ $3^x = 3^{-3}$ $x = -3$

4. $8^{x+2} = 4^{1-x}$ $2^{3(x+2)} = 2^{2(1-x)}$ $3x+6 = 2-2x$ $5x = -4$
 $x = -\frac{4}{5}$

5. $125^x = 25^{\frac{1}{4}x}$ $5^{3x} = 5^{2(\frac{1}{4}x)}$ $5^{3x} = 5^{\frac{1}{2}x}$ $3x = \frac{1}{2}x$
 $6x = x$ $5x = 0$ $x = 0$

6. $\left(\frac{1}{6}\right)^{4-x} = 216^{x-1}$ $(6^{-1})^{4-x} = 6^{3(x-1)}$ $-4+x = 3x-3$ $-1 = 2x$
 $-\frac{1}{2} = x$

7. True or False: $64^{\frac{1}{4}} = 16^{\frac{3}{8}}$ $(4^3)^{\frac{1}{4}} = (4^2)^{\frac{3}{8}}$ $4^{\frac{3}{4}} = 4^{\frac{3}{4}}$ True

$$8. 3^x = 6 \quad \log 3^x = \log 6 \quad x \log 3 = \log 6 \quad x = \frac{\log 6}{\log 3}$$

$$x \approx 1.6309$$

$$9. 9^x = 4 \quad \log 9^x = \log 4 \quad x \cdot \log 9 = \log 4 \quad x = \frac{\log 4}{\log 9}$$

$$x \approx 1.5850$$

$$10. 4^{x-1} = 12 \quad \log(4^{x-1}) = \log 12 \quad (x-1) \log 4 = \log 12$$

$$x-1 = \frac{\log 12}{\log 4} \quad x = \frac{\log 12}{\log 4} + 1 \quad x \approx 2.7925$$

$$11. 2^3 = 3^{\frac{1}{2}x} \quad \log 2^3 = \log(3^{\frac{1}{2}x}) \quad \log 8 = \frac{1}{2}x \log 3$$

$$\frac{\log 8}{\log 3} = \frac{1}{2}x \quad \frac{2 \log 8}{\log 3} = x \quad x \approx 3.7856$$

$$12. 6^{x+2} + 7 = 5^2 \quad 6^{x+2} = 18 \quad \log 6^{x+2} = \log 18 \quad (x+2) \log 6 = \log 18$$

$$x+2 = \frac{\log 18}{\log 6} \quad x = \frac{\log 18}{\log 6} - 2 \quad x \approx -0.3869$$

$$\ln e = 1$$

$$13. e^x = 21 \quad \ln e^x = \ln 21 \quad x \cdot \ln e = \ln 21 \quad x = \ln 21$$

$$x \approx 3.0445$$

$$14. 3^x = e^2 \quad \log 3^x = \log e^2 \quad x \log 3 = \log e^2 \quad x = \frac{\log e^2}{\log 3}$$

$$x \approx 1.8205$$